HOW DOES CURRENCY RISK FROM THE EMERGING MARKETS AFFECT
RETURNS OF THE U.S. INVESTORS?

by

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BComm in finance, Concordia University, 2018

and

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PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF
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MASTER OF SCIENCE IN FINANCE

In the Master of Science in Finance Program
of the
Faculty
of
Business Administration

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Approval

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Degree: Master of Science in Finance

Title of Project: How does currency risk from the emerging markets affect returns of the U.S. investors?

Supervisory Committee:

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Dr. Deniz Anginer
Senior Supervisor
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Lecturer

Date Approved: ____________________________
Abstract

This paper demonstrates how U.S. stock returns correlate with emerging market stock returns in Brazil, China, Mexico, India and Turkey, and the correlation among these emerging market returns. The emerging market returns have two components: local currency stock market return and exchange rate return. The currency risk is driven by standard deviation and correlation. By breaking down the correlation and standard deviation into foreign exchange rate return and local stock return components, we conclude that emerging markets have diversification benefits.

Keywords: emerging markets; correlation; standard deviation; diversification; volatility
Acknowledgements

We would like to express our deep and sincere gratitude to Dr. Deniz Anginer, our research senior supervisor, for his time and guidance on this project. We also really thankful to the advice from Dr. Victor Song on our project.
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1: Introduction of Capital Markets

*Figure 1.1 Distribution of countries with largest stock markets worldwide in 2018

The United States is the world’s largest stock market, accounting for 50% of the world’s total stock market value, but emerging markets are growing rapidly. Capital markets in emerging countries can offer international investment opportunities for U.S. investors but they also carry more risk. Shawky et al. (1997) showed that the potential diversification gains are substantial when developing countries are included in the set of investment opportunities.

Lipsky (2017) stated that an undeniable good trend is that more and more international investors would like to purchase emerging market [EM] securities denominated in the local currency. For U.S. investors, emerging markets offer plenty of investment opportunities, making it possible for their portfolios to be globally diversified and providing more hedging opportunities.
When investors trade in emerging markets, they face two component kinds of the return: local stock market return and foreign exchange [FX] rate return. From the perspective of U.S. investors, quantifying foreign exchange risk by observing standard deviations and correlations among emerging markets can help make better investment decisions.

1.1 U.S.

The United States has the largest capital market in the world, with $29 trillion (U.S. dollars) invested in 3,500 listed companies. The U.S. stock market is the most important in the world economy. As the most prominent economic entity in the world, the United States GDP has increased steadily in recent years.

1.2 Brazil

After the Brazilian government started to construct the capital market and implement financial reforms, Brazil’s stock market developed rapidly. The Brazil Stock Exchange is one of the world’s largest, the second largest in the Western Hemisphere, and the largest in Latin America. By the end of 2018, the Brazilian stock market’s capitalization reached $916 billion, 49.06% of the country’s GDP for 2018.

1.3 China

China's capital market has grown rapidly in recent years and is predicted to become one of the largest and most liquid in the world. Currently, there are approximately 3,800 listed companies. The total market value has reached $10
trillion, and the securitization rate was about 90%, which is close to that of a
developed market. As a result, international investors will likely begin to invest in
China's capital market.

1.4 India

India’s stable economic growth in recent years has attracted cash inflow into its
capital market, and capital is flowing into India continuously. India’s relatively steady
economic growth has ensured the stability of its capital market. As a result, the 1997
Southeast Asian financial crisis and the Vietnam economic crisis in 2008 did not
impact India significantly. Over 5,000 companies are listed on the Bombay Stock
Exchange, and the total market value has reached $1.7 trillion U.S. dollars. Among
global stock exchanges, the Bombay Stock Exchange Limited is the third largest
index and options trading center in the world.

1.5 Mexico

In 2018, the total market capitalization was $281.56 billion in Mexico. Mexico,
with its unique location, abundant resources, and improvement of the investment
environment, has attracted many foreign investments, becoming one of the Latin
American countries preferred by foreign investors.

1.6 Turkey

Turkey is another booming emerging economy after China, Russia, India, Brazil,
and South Africa. In 2017, Turkey's gross domestic product (GDP) reached about
$850.7 billion with an increase of 7.4% over the previous year. Despite recent political turmoil and step-backs, Turkey encourages the free cash flow of financial investments. The total market capitalization in 2018 was $163.26 billion.

The market potential of the above EM stock markets is great, and these markets can provide more investment opportunities for U.S. investors.

2: How Emerging Market Differentiates from Developed Market

An emerging market is defined as the countries which are in the process of high growth development with relatively low GDP per capital ("What is the difference between a developed, emerging, and frontier market?" 2012).

Since emerging markets [EM] experience a high growth rate, the capital market faces unexpected instability and volatility. A lack of transparency is a problem in emerging markets because there is little information about publicly traded companies, further political environment in countries mentioned above are often unstable. While EM markets provide increasing investment opportunities, they also bring more risks. As a result, investors need to think carefully about their investment decisions.

3: Summary Statistics

Presenting data from 2006 to 2018, the table (see Exhibit 1) shows each market’s stock return in local currency. “EM” represents the emerging market. The daily stock return and daily foreign exchange rate were used, and data were processed on a 66-day rolling basis. Assuming investors invest the same amount in the markets of Brazil,
China, India, Mexico, and Turkey, EM is the portfolio that takes an average of each daily return of the five emerging markets.

In figure 3.1, the relationship between volatility and return can be directly observed. The EM portfolio has the lowest risk among these markets, while China has the highest volatility. As a country also located in Asia, India has a lower risk but a higher return than China.

*Figure 3.1 EM and U.S. Markets Local Returns*

In figure 3.2, the dots are more decentralized compared with figure 3.1. The foreign exchange rate has impacted returns and risks and has provided different investment opportunities.

When engaging in global investments, two factors affect U.S. investors’ returns: foreign exchange rate return and local emerging market return. Compared with the local return of EMs, the return of the Chinese market increased to 0.054%. Other markets’ returns decreased, but volatility increased, especially for Turkey. Turkish returns decreased significantly while volatility increased. This increase in volatility is
mainly derived from the exchange rate and the correlations.

*Figure 3.2 EM Returns in USD*

![](image)

*Table 3.1 Correlation Table of FX Returns & the U.S. Market*

This table shows the correlation between each country’s foreign exchange rate return and the U.S. stock market.

<table>
<thead>
<tr>
<th></th>
<th>BRL/USD</th>
<th>CHN/USD</th>
<th>INR/USD</th>
<th>MEX/USD</th>
<th>TRY/USD</th>
<th>EM average/USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>0.2800</td>
<td>0.0517</td>
<td>0.2100</td>
<td>0.3676</td>
<td>0.3027</td>
<td>0.3823</td>
</tr>
</tbody>
</table>

What effect does the exchange rate have on U.S. investors? This can be determined based on the relationship between the U.S. stock market return and the foreign exchange rate return. After the exchange rate was added, the return of all countries (except China) and the EM portfolio decreased, and the volatility increased. Exchange rates make volatility higher in most countries, and U.S. investors have higher investment risks in these counties (Brazil, India, Mexico, and Turkey).

*Table 3.2 Difference between Standard Deviations with and without FX rate return*

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>EM</th>
</tr>
</thead>
<tbody>
<tr>
<td>STD (without)</td>
<td>1.38%</td>
<td>1.64%</td>
<td>1.32%</td>
<td>1.10%</td>
<td>1.50%</td>
<td>0.92%</td>
</tr>
<tr>
<td>STD (with)</td>
<td>2.00%</td>
<td>1.66%</td>
<td>1.58%</td>
<td>1.54%</td>
<td>2.13%</td>
<td>1.26%</td>
</tr>
<tr>
<td></td>
<td>0.61%</td>
<td>0.02%</td>
<td>0.26%</td>
<td>0.44%</td>
<td>0.63%</td>
<td>0.34%</td>
</tr>
</tbody>
</table>
The impact that the FX rate has can be determined by calculating the difference between the markets’ standard deviations with the FX rate return and the markets’ standard deviations without the FX rate return. After taking the FX rate into consideration, the volatility of the portfolios of China and EM does not increase significantly, so the EM portfolio can help U.S. investors diversify risk.

**4: The Volatilities of Different Markets and Returns**

The risk considered can be divided into three parts: the volatility from local market returns, the volatility of exchange rate returns, and the correlations between market returns in USD and exchange rate returns. In the following sections, charts are used to illustrate the differences between volatilities in different countries, respectively.

*Figure 4.1 Standard Deviation of Brazil’s Market Return, Return in USD, and Exchange Rate Return*

The standard deviation gives hints about the volatility of markets. Both the volatility of local returns and the volatility of the exchange rate contribute to the volatility of market returns. Figure 4.1 shows that in the final period of the financial
crisis from 2008 to 2009, both the exchange rate market and Brazil’s market became more volatile. Consequently, Brazil’s market return in USD became more volatile as well.

Figure 4.2 Standard Deviation of Mexico’s Market Return, Return in USD, and Exchange Rate Return

![Graph showing the standard deviation of Mexico’s market return, return in USD, and exchange rate return.]

Figure 4.3 Standard Deviation of Turkey’s Market Return, Return in USD, and Exchange Rate Return

![Graph showing the standard deviation of Turkey’s market return, return in USD, and exchange rate return.]

Mexico and Turkey were similar to Brazil during the global recession; however, for Mexico, from 2005 to 2008, the risk of the exchange rate generated more influence on market returns in USD than the volatility of local returns. The same scenario occurred in Turkey in the most recent two years. Turkey experienced a severe financial crisis in 2008. The TRL (Yeni Türk Lirası, Turkish currency) to USD
depreciated by 45%. Some brokers stopped trading in the exchange rate market, and after the Turkish government adjusted its interest rate to respond to inflation, the exchange rate market became less volatile.

Figure 4.4 Standard Deviation of India’s Market Return, Return in USD, and Exchange Rate Return

At times from 2006 to 2009, the volatility of local returns was higher than the volatility of market returns in USD in India. This is because the correlations between exchange rate returns and the U.S. market return negative were negative (see Exhibit 6.3 for correlation information).

Figure 4.5 Standard Deviation of China’s Market Return, Return in USD, and Exchange Rate Return

China’s situation is different from the counties represented in figure 4.5. The
volatility of the Chinese market is the primary factor affecting the volatility of the Chinese market return in USD. The standard deviation of market returns in USD is slightly higher than the standard deviation of pure market returns. This is because the correlations between the exchange rate (USD/RMB) and the U.S. market return are around zero (see Exhibit 6.2 for correlation information), which only slightly influences the standard deviation of Chinese market returns in USD. The other reason is that China has a low standard deviation of exchange rate returns due to strict policies applied by the Chinese government on the foreign exchange market (“How Does China Control Exchange Rates?” 2016). Therefore, the exchange rate of return does not bring more risk for American investors who trade in the Chinese market; however, due to the recent trade war between China and the U.S., the exchange rate (USD/RMB) is fluctuating. The fluctuation brings about more volatilities when American investors invest in the Chinese market.

5: The Changes of Correlations between the U.S. Market and the Emerging Market

5.1 The correlations between the U.S. market return and the emerging market return

Table 5.1 Correlation Matrix

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>EM Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRAZIL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHINA</td>
<td>1.0000</td>
<td>0.1818</td>
<td>0.2311</td>
<td>0.3735</td>
<td>0.6739</td>
<td>0.7129</td>
</tr>
<tr>
<td>INDIA</td>
<td>0.3118</td>
<td>0.3795</td>
<td>0.2118</td>
<td>0.2465</td>
<td>0.1442</td>
<td>0.1647</td>
</tr>
<tr>
<td>MEXICO</td>
<td>0.6739</td>
<td>0.7129</td>
<td>0.1442</td>
<td>0.3735</td>
<td>0.6739</td>
<td>0.7129</td>
</tr>
<tr>
<td>TURKEY</td>
<td>0.3709</td>
<td>0.5313</td>
<td>0.1287</td>
<td>0.3638</td>
<td>0.4184</td>
<td>0.5313</td>
</tr>
<tr>
<td>USA</td>
<td>0.6416</td>
<td>0.5846</td>
<td>0.0964</td>
<td>0.2752</td>
<td>0.2944</td>
<td>0.0698</td>
</tr>
</tbody>
</table>
Table 5.1 provides a correlation matrix of daily local stock returns among five markets and one portfolio, which is invested equally in each EM. In general, all the correlations are positive, which means each stock market is affected by other stock markets to some extent. The stock prices tend to move in the same direction but in different amounts.

From the perspective of U.S. investors, after adding the FX rate into the calculation, China, India, and Turkey’s correlations with the U.S. market increase. When U.S. investors engage in these three emerging stock markets, the increasing correlation may lead to increasing losses in China, India, and Turkey stock markets if the U.S. market does not perform well; however, the U.S. market’s correlations with Brazil and Mexico as well as the correlation between the U.S. market and the EM portfolio decrease. Therefore, the EM portfolio is an excellent investing choice for diversification because investing in a diversified portfolio (EM portfolio) can reduce risk; however, the correlation between the U.S. market and Brazil’s market return in USD, the correlation between the U.S. market and Mexico’s market return in USD, and the correlation between the U.S. market and the EM’s portfolio return in USD are still higher than the correlation between the U.S. market and the market returns of China, India, and Turkey in USD.

The correlations vary among these EM markets. Although Brazil and Mexico’s markets have relatively low correlations with other EMs, they have a relatively high
co-movement with the U.S., which is able to dominate their economies. The correlations between the U.S. and China, India, and Turkey are low, and China maintains the lowest correlations with other foreign markets.

According to Jia (2017), the location of countries plays a vital role in determining the correlation coefficient structure. Table 4.1 clearly illustrates how the location can affect the correlation.

In general, the closer the countries are to each other, the higher the correlation. Table 5.1 shows that China has a higher correlation with India compared with Brazil, Mexico, Turkey, and the U.S. due to geography, and countries located in Asia have a lower correlation with the U.S., such as China and India, while Brazil and Mexico, which are located in South and Central America, have higher correlations with the U.S. Hence, when the U.S. stock market performs well, U.S. investors engaged in Brazil and Mexico’s stock markets will benefit more than for those of China and India. U.S. investors can invest in different EMs at one time and can gain benefits from diversification.

The correlation between the U.S and emerging countries in Asia increases, while the correlation between the U.S and emerging countries in South and Central America decreases. The correlations between the U.S. stock market return and the returns of China and India in USD increased. The FX rate produced a positive effect on all three countries; however, the correlation between the U.S. market return and the returns of Brazil and Mexico in USD decreased, indicating that the FX rate has negative effects
on these two markets. Although the correlations decrease, these two correlations are still higher than the correlation between the U.S. stock return and the returns of China, India, and Turkey in USD. The EM portfolio combines these EM changing trends together and shows an outstanding result that the correlation between the U.S. market and the EM portfolio decreased.

After the FX rate was added to the calculation, the correlation between each two of these five EMs increased. Therefore, diversifying risk is difficult when EM returns are converted to USD. Although the correlation with the stock markets of other countries increased after adding the exchange rate to the calculation, the overall correlation between China and other markets was not apparent. Hence, the globalization trend of China’s stock market is weak, and the degree of liberalization of the stock market is low. The fluctuations of other stock markets are unlikely to affect the Chinese stock market.

### 5.2 The correlations between the U.S. market return and the exchange rate return

In general, all these countries show positive correlations between exchange rates and the U.S. market return. Mexico, Brazil, and Turkey have higher exchange rate correlations with the U.S. market (see Exhibit 6.1, 6.4, and 6.5). China and India have lower correlations with the U.S. market (see Exhibit 6.2 and 6.3). Because each country is not perfectly correlated with the U.S. market, American investors can diversify their risks. In various periods, each country has a negative correlations
between exchange rate returns and the U.S. market. For example, INR (Indian Rupee)/USD is negatively correlated with the U.S. market during the global recession from 2006 to 2008. The negative correlations between the exchange rate and the U.S. market can help American investors offset some of their losses in some specific periods.

5.3 The correlation of foreign exchange rate returns between countries

*Table 5.2 Correlation Matrix with Six Markets*

The table shows the correlations of FX rate returns between countries.

<table>
<thead>
<tr>
<th></th>
<th>BRL/USD</th>
<th>CHN/USD</th>
<th>INR/USD</th>
<th>MEX/USD</th>
<th>TRY/USD</th>
<th>EM FX return</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRL/USD</td>
<td>1.0000</td>
<td>0.1312</td>
<td>0.3226</td>
<td>0.5632</td>
<td>0.4739</td>
<td>0.8250</td>
</tr>
<tr>
<td>CHN/USD</td>
<td>0.1312</td>
<td>1.0000</td>
<td>0.1663</td>
<td>0.1394</td>
<td>0.1422</td>
<td>0.2455</td>
</tr>
<tr>
<td>INR/USD</td>
<td>0.3226</td>
<td>0.1663</td>
<td>1.0000</td>
<td>0.3559</td>
<td>0.3397</td>
<td>0.5727</td>
</tr>
<tr>
<td>MEX/USD</td>
<td>0.5632</td>
<td>0.1394</td>
<td>0.3559</td>
<td>1.0000</td>
<td>0.4969</td>
<td>0.7939</td>
</tr>
<tr>
<td>TRY/USD</td>
<td>0.4739</td>
<td>0.1422</td>
<td>0.3397</td>
<td>0.4969</td>
<td>1.0000</td>
<td>0.7939</td>
</tr>
<tr>
<td>EM FX return</td>
<td>0.8250</td>
<td>0.2455</td>
<td>0.5727</td>
<td>0.7939</td>
<td>1.0000</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

U.S. investors can gain or lose when they convert their returns to USD. Hence, the correlations between different countries can significantly affect U.S. investors’ returns. The correlations between the EM FX rate and other FX rates are high, especially the correlation between the EM FX rate and BRL/USD, the correlation between the EM FX rate and MEX/USD, and the correlation between the EM FX rate and TRY/USD. U.S. investors can invest in an EM portfolio to diversify currency risks among five emerging markets. The correlation between BRL/USD and MEX/USD is also high (0.5632) because if the BRL/USD FX rate return decreases, so does the MEX/USD rate return. U.S. investors rarely benefit from diversification by
investing in these two markets if the U.S. market performs poorly. The EM portfolio provides opportunities to diversify currency risks across countries.

6: Market Returns in Weak and Strong Market Conditions

Two scenarios were generated to determine how currency risks affect American investors in EMs. The data were divided into two groups: a weak market condition (the lowest 5% of the U.S. market return) and a strong market condition (the highest 95% of the U.S. market return). The two groups were used to reveal relationships between Brazil, Mexico, China, India, and Turkey with the U.S. market under two market conditions. The following tables show the returns and standard deviations of Brazil, Mexico, China, India, and Turkey.

Table 6.1 Market Returns

The tables describe EMs’ local returns, EMs’ returns in USD, and EMs’ exchange rate returns when the U.S. market returns are in the lowest 5th percentile and when the U.S. market returns are in the highest 95th percentile.

a. Each country’s local returns and the average EM return

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>EM Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>-2.1030%</td>
<td>-0.3517%</td>
<td>-0.7623%</td>
<td>-1.8421%</td>
<td>-1.2745%</td>
<td>-1.2667%</td>
</tr>
<tr>
<td>95%</td>
<td>0.1510%</td>
<td>0.0702%</td>
<td>0.0936%</td>
<td>0.1387%</td>
<td>0.1147%</td>
<td>0.1136%</td>
</tr>
</tbody>
</table>

b. Each country’s market returns in USD and the average EM return in USD

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>EM Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>-2.8869%</td>
<td>-0.3593%</td>
<td>-1.0221%</td>
<td>-2.5486%</td>
<td>-1.9217%</td>
<td>-1.7477%</td>
</tr>
<tr>
<td>95%</td>
<td>0.1844%</td>
<td>0.0755%</td>
<td>0.0968%</td>
<td>0.1621%</td>
<td>0.1183%</td>
<td>0.1274%</td>
</tr>
</tbody>
</table>

c. Each country’s exchange rate returns and the average EM exchange rate return

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>EM Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>-0.8083%</td>
<td>-0.0078%</td>
<td>-0.2673%</td>
<td>-0.7247%</td>
<td>-0.6686%</td>
<td>-0.4954%</td>
</tr>
<tr>
<td>95%</td>
<td>0.0288%</td>
<td>0.0056%</td>
<td>0.0011%</td>
<td>0.0211%</td>
<td>-0.0040%</td>
<td>0.0105%</td>
</tr>
</tbody>
</table>
In general, EM returns are led by the U.S. market. With or without an exchange rate return, EMs suffer from negative returns during a tough period. Furthermore, when converting back to USD, American investors suffer more losses in the EM under the lowest 5% condition; however, under a strong market condition, with the exchange rate return, all market returns return to positive and are higher than the returns without the exchange rate return. When the market condition is strong, conversion into USD helps US investors receive higher returns.

**Table 6.2 Standard Deviations**

a. The table shows the standard deviation of each country’s local returns and the average EM’s return and the standard deviation of each country’s returns and the average EM’s return in USD when the U.S. market returns are in the lowest 5th percentile.

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>USA</th>
<th>EM Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>1.8666%</td>
<td>2.2447%</td>
<td>1.9602%</td>
<td>1.4435%</td>
<td>1.8612%</td>
<td>1.3348%</td>
<td>1.2901%</td>
</tr>
<tr>
<td>5%</td>
<td>2.7014%</td>
<td>2.2571%</td>
<td>2.3098%</td>
<td>1.9905%</td>
<td>2.6996%</td>
<td>-</td>
<td>1.7822%</td>
</tr>
</tbody>
</table>

b. The table shows the standard deviation of each country’s local returns and the average EM’s return and the standard deviation of each country’s returns and the average EM’s return in USD when the U.S. market returns are in the highest 95th percentile.

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>USA</th>
<th>EM Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>95%</td>
<td>1.2576%</td>
<td>1.6037%</td>
<td>1.2640%</td>
<td>0.9849%</td>
<td>1.4447%</td>
<td>0.9511%</td>
<td>0.8380%</td>
</tr>
<tr>
<td>95%</td>
<td>1.8306%</td>
<td>1.6209%</td>
<td>1.5119%</td>
<td>1.3815%</td>
<td>1.3705%</td>
<td>-</td>
<td>0.9978%</td>
</tr>
</tbody>
</table>

c. The table shows the standard deviation of each country’s exchange rate returns and the average EM’s exchange rate return.

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>EM Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>1.6370%</td>
<td>0.1796%</td>
<td>0.6660%</td>
<td>1.0092%</td>
<td>1.1956%</td>
<td>0.7558%</td>
</tr>
<tr>
<td>95%</td>
<td>0.9341%</td>
<td>0.1575%</td>
<td>0.4698%</td>
<td>0.6958%</td>
<td>0.8952%</td>
<td>0.4808%</td>
</tr>
</tbody>
</table>

Under a weak market condition, the volatility of the exchange rate return (0.7558%) is higher than under a healthy market condition (see table 8.2b). The high volatility of exchange rate returns leads to a higher volatility of returns in USD (see exhibit 5b); however, when the market condition is favorable, the volatility of average
market returns in USD is higher than the volatility of average local returns by only 0.1598%. Nevertheless, when the global market is under a weak condition, the average market return in USD is more volatile than the average local market return by 0.4901%.

7: Conclusion

This article examines returns, standard deviations, and correlations to understand how currency risk affects American investors’ investments in EMs. The conclusions are as follows.

Overall, American investors can benefit from the EM portfolio. The EM portfolio can be used to diversify American investors’ risks. In addition, investing in an EM portfolio is less risky than investing money in a specific emerging country for American investors.

Under a weak market condition (the lowest 5% U.S. market return), both the U.S. market and the emerging countries have negative returns. The EM returns in USD are worse than the emerging local returns. In contrast, under a strong market condition (the highest 95% U.S. market return), both the U.S. market and the emerging countries have positive returns. With the exchange rate, each emerging country’s return performs better than each emerging country’s local return.

Because EMs are becoming increasingly open to American investors, there are opportunities for American investors to pursue more profits; however, the way to manage currency risk is still under question for these investors.
Appendices

Exhibit 1 EM and U.S. Markets Local Returns

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>EM</th>
<th>USA</th>
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</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.04%</td>
<td>0.05%</td>
<td>0.05%</td>
<td>0.04%</td>
<td>0.05%</td>
<td>0.04%</td>
<td>0.03%</td>
</tr>
<tr>
<td>STD</td>
<td>1.38%</td>
<td>1.64%</td>
<td>1.32%</td>
<td>1.10%</td>
<td>1.50%</td>
<td>0.92%</td>
<td>1.20%</td>
</tr>
</tbody>
</table>

Exhibit 2 EM Local Returns in USD

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>EM</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.03%</td>
<td>0.05%</td>
<td>0.04%</td>
<td>0.03%</td>
<td>0.02%</td>
<td>0.03%</td>
<td></td>
</tr>
<tr>
<td>STD</td>
<td>2.00%</td>
<td>1.66%</td>
<td>1.58%</td>
<td>1.54%</td>
<td>2.13%</td>
<td>1.26%</td>
<td></td>
</tr>
</tbody>
</table>

Exhibit 3 Correlation Matrix of EM markets local return

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>USA</th>
<th>EM local</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRAZIL</td>
<td>1.0000</td>
<td>0.1685</td>
<td>0.3118</td>
<td>0.6739</td>
<td>0.3709</td>
<td>0.6416</td>
<td>0.7354</td>
</tr>
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<td>1.0000</td>
<td>0.2318</td>
<td>0.1442</td>
<td>0.1287</td>
<td>0.0964</td>
<td>0.5530</td>
</tr>
<tr>
<td>INDIA</td>
<td>0.3118</td>
<td>0.2318</td>
<td>1.0000</td>
<td>0.2941</td>
<td>0.3638</td>
<td>0.2752</td>
<td>0.6550</td>
</tr>
<tr>
<td>MEXICO</td>
<td>0.6739</td>
<td>0.1442</td>
<td>0.2941</td>
<td>1.0000</td>
<td>0.3734</td>
<td>0.6981</td>
<td>0.7022</td>
</tr>
<tr>
<td>TURKEY</td>
<td>0.3709</td>
<td>0.1287</td>
<td>0.3638</td>
<td>0.3734</td>
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<td>0.3521</td>
<td>0.6796</td>
</tr>
<tr>
<td>USA</td>
<td>0.6416</td>
<td>0.0964</td>
<td>0.2752</td>
<td>0.6981</td>
<td>0.3521</td>
<td>1.0000</td>
<td>0.5904</td>
</tr>
<tr>
<td>EM local market</td>
<td>0.7354</td>
<td>0.5530</td>
<td>0.6550</td>
<td>0.7022</td>
<td>0.6796</td>
<td>0.5904</td>
<td>1.0000</td>
</tr>
</tbody>
</table>

Exhibit 4 Correlation Matrix of EM markets return in USD

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
<th>CHINA</th>
<th>INDIA</th>
<th>MEXICO</th>
<th>TURKEY</th>
<th>USA</th>
<th>EM FX return</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRAZIL</td>
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<td>0.7129</td>
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<td>0.1675</td>
<td>0.8094</td>
</tr>
<tr>
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<td>0.1848</td>
<td>1.0000</td>
<td>0.2465</td>
<td>0.1647</td>
<td>0.1360</td>
<td>0.1735</td>
<td>0.4697</td>
</tr>
<tr>
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<td>0.2465</td>
<td>1.0000</td>
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<tr>
<td>USA</td>
<td>0.1675</td>
<td>0.1735</td>
<td>0.2576</td>
<td>0.6688</td>
<td>0.7874</td>
<td>1.0000</td>
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</tr>
<tr>
<td>EM FX return</td>
<td>0.8094</td>
<td>0.4697</td>
<td>0.6688</td>
<td>0.7874</td>
<td>0.5787</td>
<td>1.0000</td>
<td></td>
</tr>
</tbody>
</table>

Exhibit 5 Standard Deviations

a. The table shows the standard deviation of each country’s local returns and the average emerging market’s return when the U.S. market has the lowest 5% returns and the highest 95% returns.
b. The table shows the standard deviation of each country’s market returns in USD and the average emerging market’s return in USD when the U.S. market has the lowest 5% returns and the highest 95% returns.

<table>
<thead>
<tr>
<th></th>
<th>BRAZIL</th>
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<th>MEXICO</th>
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<tbody>
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<td>1.4435%</td>
<td>1.8612%</td>
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<td>1.2901%</td>
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<td>1.6037%</td>
<td>1.2640%</td>
<td>0.9849%</td>
<td>1.4447%</td>
<td>0.9511%</td>
<td>0.8380%</td>
</tr>
</tbody>
</table>

Exhibit 6.1 Correlation of the Brazil FX return with the U.S. market return
Exhibit 6.2 Correlation of the China FX return with the U.S. market return

Exhibit 6.3 Correlation of the India FX return with the U.S. market return
Exhibit 6.4 Correlation of the Mexico FX return with the U.S. market return

Exhibit 6.5 Correlation of the Turkey FX return with the U.S. market return
Reference List


